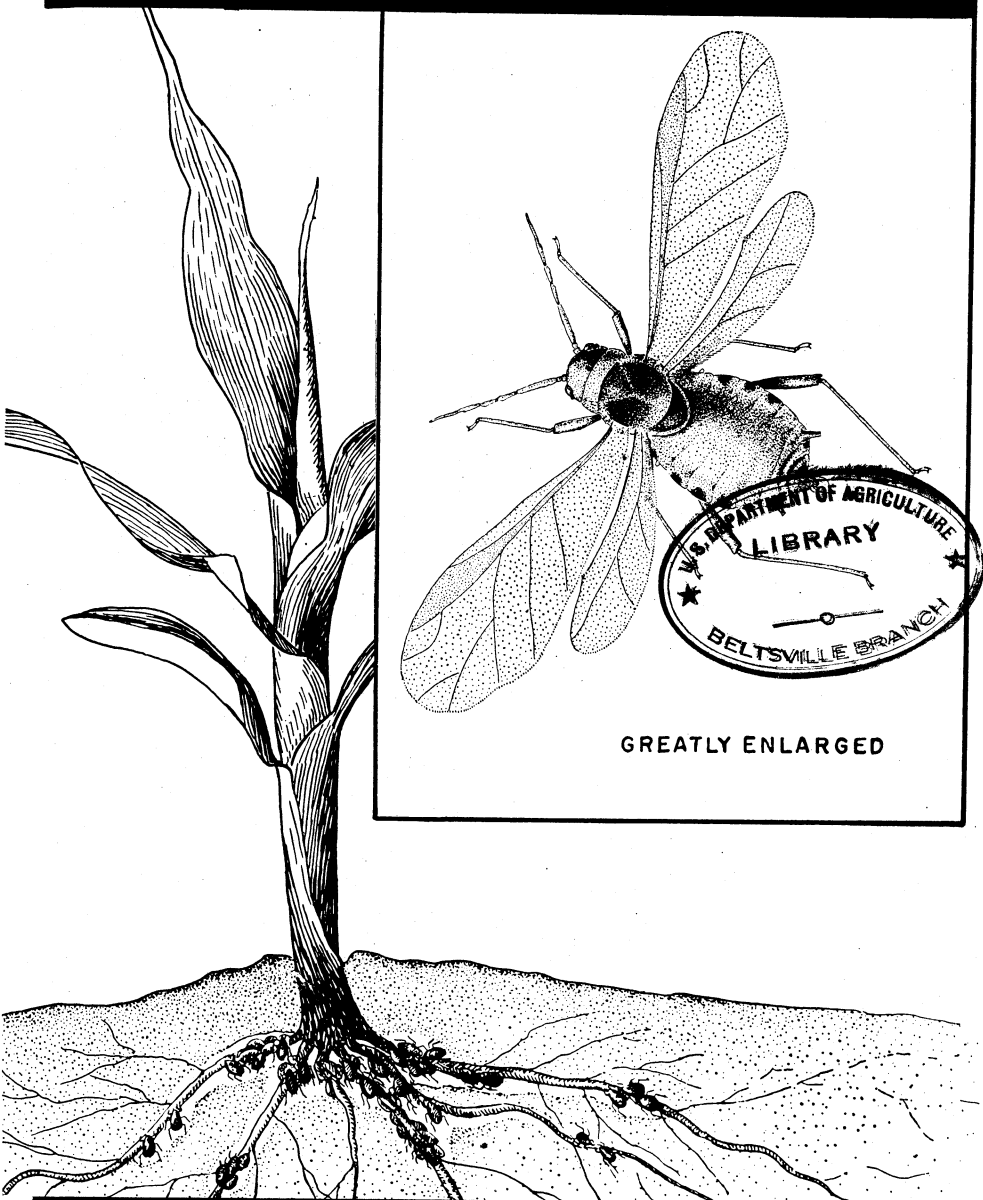


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The CORN ROOT APHID and methods of controlling it



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THE CORN ROOT APHID can be controlled by the simple practices described in this bulletin. In addition to corn, this insect feeds on the roots of cotton, asters, and certain weeds. It is fostered by a common species of field ant, which must be dealt with before the aphid can be destroyed.

The control measures are—

1. Crop rotation;
2. Early and deep spring plowing followed by several deep diskings to disorganize the colonies of aphids and ants and to prevent the growth of weeds on which the aphids live before they attack corn;
3. The use of barnyard manure or commercial fertilizer as an aid in producing stronger plants, so that they will resist injury.

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THE CORN ROOT APHID AND METHODS OF CONTROLLING IT

By JOHN J. DAVIS, *entomological assistant, Division of Cereal and Forage Insect Investigations, Bureau of Entomology and Plant Quarantine, Agricultural Research Administration*¹

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THE CORN ROOT APHID² causes serious injury to growing corn each year. It is distributed generally throughout the United States east of the Rocky Mountains, but it is an especially destructive pest in the Corn Belt and in southern Wisconsin. Its abundance and destructiveness in this region may be traced to the practice of growing two or more successive crops of corn on the same land, and this fact has direct bearing on the practical control of the insect. It also is injurious to cotton in the South Atlantic States and to cultivated asters almost everywhere.

HOW THE CORN ROOT APHID INJURES CORN

The corn root aphid (fig. 1) is a small, soft-bodied insect not larger than a pinhead, almost spherical when full-grown, and of a bluish-

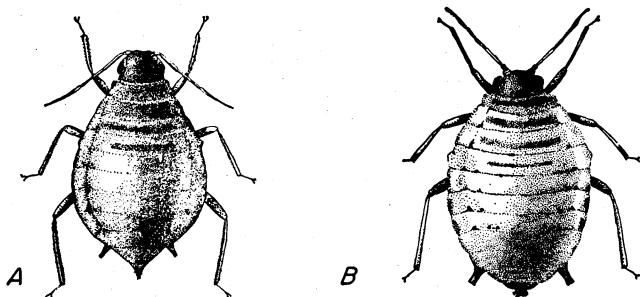


Figure 1.—Corn root aphid: A, Wingless female, the form that produces living young; B, egg-laying female. Greatly enlarged. (Redrawn from Forbes.)

¹ Resigned May 1, 1919. This revision was prepared by C. M. Packard, in charge, Division of Cereal and Forage Insect Investigations.

² *Anuraphis maidi-radici* (Forbes).

green color, more or less dusted with a fine whitish powder which makes it appear grayish green. The aphids cluster on the corn roots and suck the plant juices. This causes a continual drain on the plant and affects it in the same way as a drought would. The injury is most noticeable in the spring before the plants have made any considerable growth. Infested plants are dwarfed, and the leaves become brown or otherwise discolored. Usually they do not make any appreciable growth, although even the heavily infested plants seldom are killed outright. Infestations later in the season are less noticeable, and indeed seldom are recognized because the plants as a rule are not injured outwardly. The extent of damage varies with the season; conditions favoring the growth of corn sometimes enable the plants to make a fair development in spite of the insect, and in an unfavorable season the injury is more conspicuous.

Injury by the corn root aphid may be distinguished from that caused by other insects by the following conditions: (1) Root aphids usually attack corn that is grown on land that was in corn the previous year; (2) a stunting of the plants and yellowing of the leaves usually occurs early in the summer, when the plants are 6 to 18 inches high; (3) ant hills and the common brown cornfield ants are to be found near corn plants attacked by root aphids; (4) when the plants are uprooted the bluish-green aphids will be found thickly clustered on the roots and on the under side of the crown at the base of the roots.

SEASONAL HISTORY AND HABITS

There are four forms of the corn root aphid—the males, the egg-laying females (fig. 1, *B*), and the winged and the wingless females (fig. 1, *A*) that bear living young.

The true sexes—the males and the egg-laying females—occur only in the fall. These females lay pale yellowish-green eggs, which later turn to jet black. Ants take the aphid eggs to their nests and care for them during the winter. In the spring and throughout the summer only the winged and wingless females that bear living young are to be found.

The seasonal history of this insect, which is outlined in figure 2, is as follows: The eggs, which are kept by the ants in their nests over winter, begin to hatch about the time smartweed seeds begin to germinate—usually the latter part of March or the first of April—and the young, frail aphids are transferred by the attentive ants to the roots of convenient weeds along which tunnels have previously been made. The aphid is able to live and reproduce on a large variety of weeds, but is most frequently found on such common field weeds as smartweed or knotweed, crabgrass, purslane, and foxtail or pigeongrass. The young that hatch from eggs mature in about 15 days and give birth to a second generation. Members of this and the succeeding generations until fall give birth to living young, which they produce without fertilization by a male.

About 16 or 17 generations occur between the date of hatching in the spring and fall, and the length of each generation varies according to the season, being longer in the spring and fall and shorter in the summer. Since each female gives birth to 40 or 50 young, and the young mature and themselves produce young in 6 to 8 days during the summer months, it may be easily understood that they increase

to enormous numbers and that the killing of one aphid early in the season is equal to the destruction of hundreds or even thousands in midsummer or later.

The first two or three generations live on the roots of weeds, but as soon as the corn sprouts, the ants transfer the aphids to the more succulent corn roots. Aphids are to be found on the roots of both corn and weeds throughout the summer, wingless individuals always predominating. After the second or third generation, however, a considerable number of the aphids may be winged, and many of these come out of the ground through the ant tunnels and fly away to a new field. If they chance to alight near an ant hill, they are seized immediately by the watchful ants, carried into the burrow, and placed on a convenient root, where they give rise to another infestation. In this way corn on new ground, but near heavily infested fields, occasionally becomes so badly infested by late summer that the crop is damaged. For this reason community cooperation is important in fighting this pest.

The males and the egg-laying females begin to appear about the first of October, and the eggs laid by these females are immediately stored by the attendant ants. As cold weather approaches, the ants carry the eggs with their own young deeper into the soil, and usually by the middle of November, in the latitude of Illinois and Wisconsin, all will be found 8 inches or more below the surface, which is below the ordinary plow furrow. Fall plowing should therefore be done as early as possible so that the ant colonies may be destroyed. Similarly in summer, during periods of drought, the ant colonies may be found 8, 10, or even 12 inches below the surface.

RELATION BETWEEN ANTS AND THE APHIDS

Several species of ants foster the corn root aphid, but by far the most common species occurring in the fields is the small brown ant known as the cornfield ant.³ In the fall the ants carry the aphid eggs to their nests and care for them as they do for their own young, and in spring when the eggs hatch they tunnel along weed roots and place the helpless aphids on the host plant (fig. 3). The aphids are cared for in the same way during the summer months. Indeed, throughout life they are wholly dependent on the ant, which obtains in return for its work a sweetish fluid, the predigested sap of the corn or other plant, which is given off in considerable quantities by the aphids. Since the aphids are entirely dependent on the ants, it is evident that any measure which will disturb, disorganize, or destroy the ant colonies will reduce the numbers of aphids. This point will be explained further under Methods of Control.

HISTORY OF THE APHID IN THE UNITED STATES

As early as 1822 root aphids, probably the corn root aphid, were reported damaging corn in Pennsylvania. In 1862 this species was definitely observed attacking corn roots and injuring the crop in Illinois. Previous to 1891 the corn root aphid was generally supposed to be the subterranean form of the corn leaf aphid,⁴ which is every-

³ *Lasius niger alienus americanus* Emery.

⁴ *Aphis maidis* Fitch.

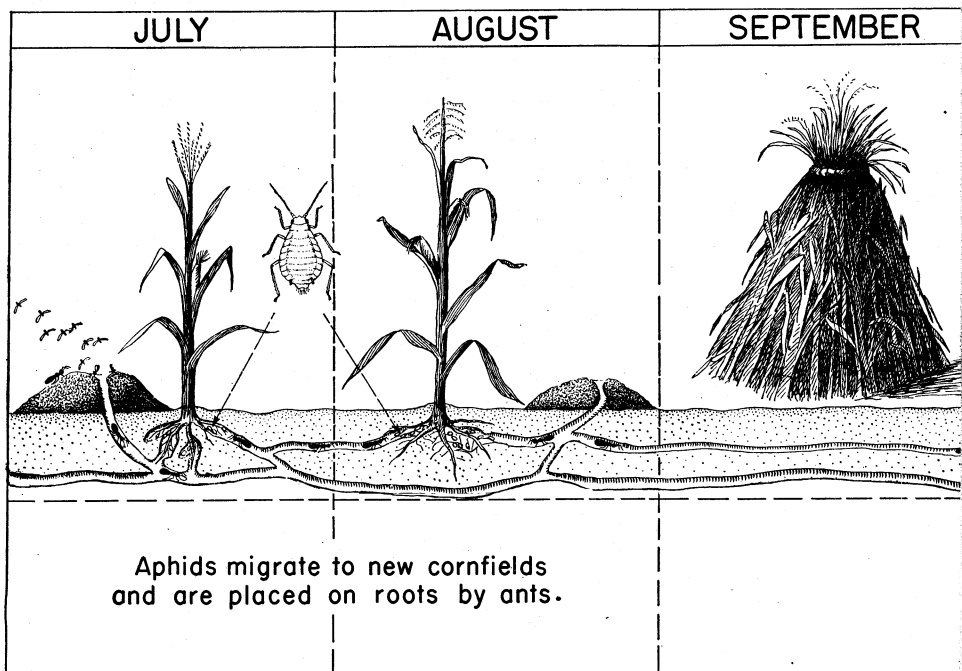
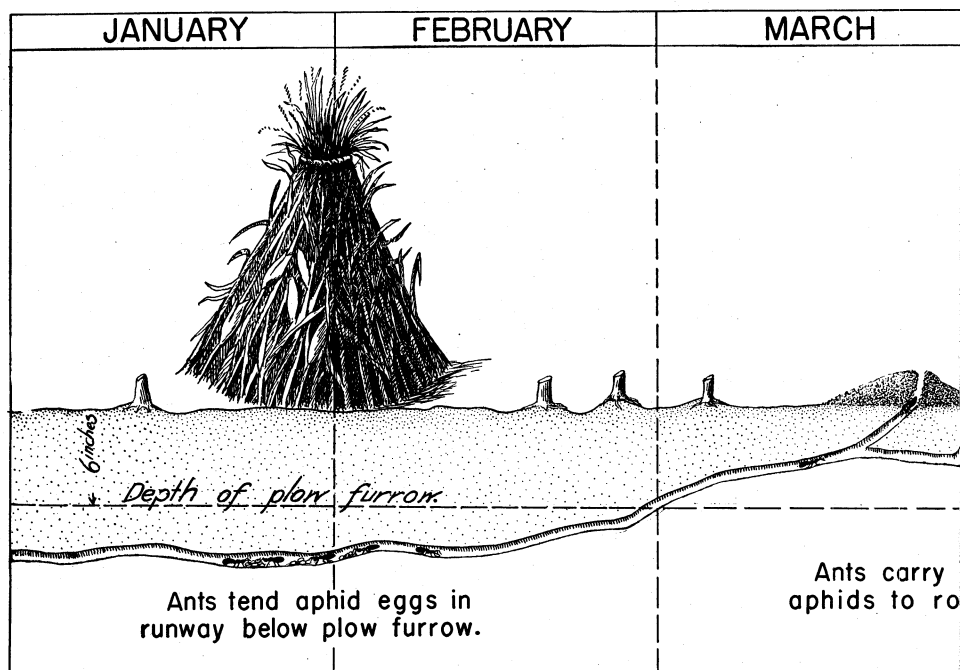
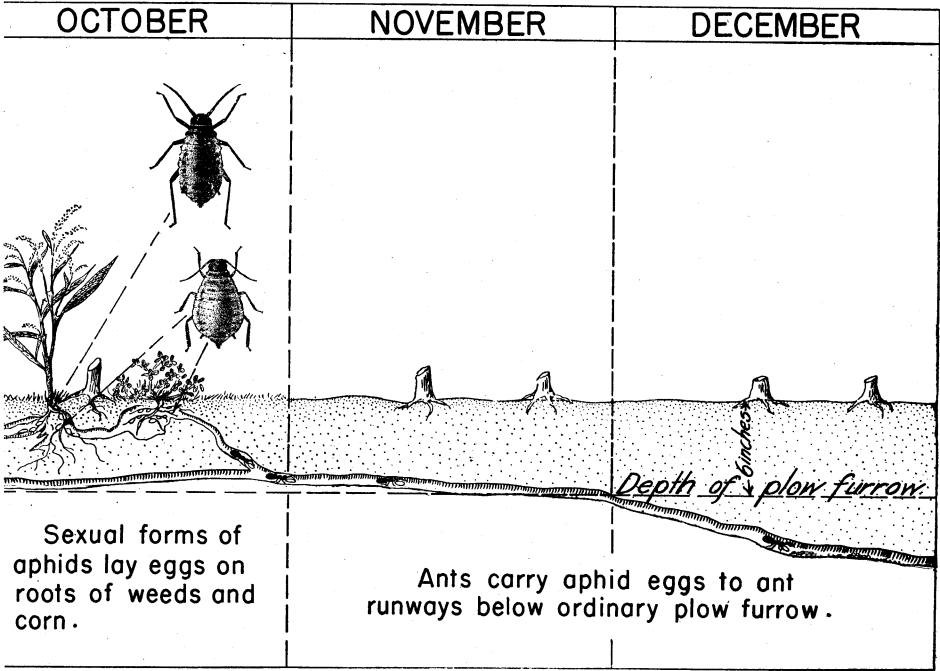
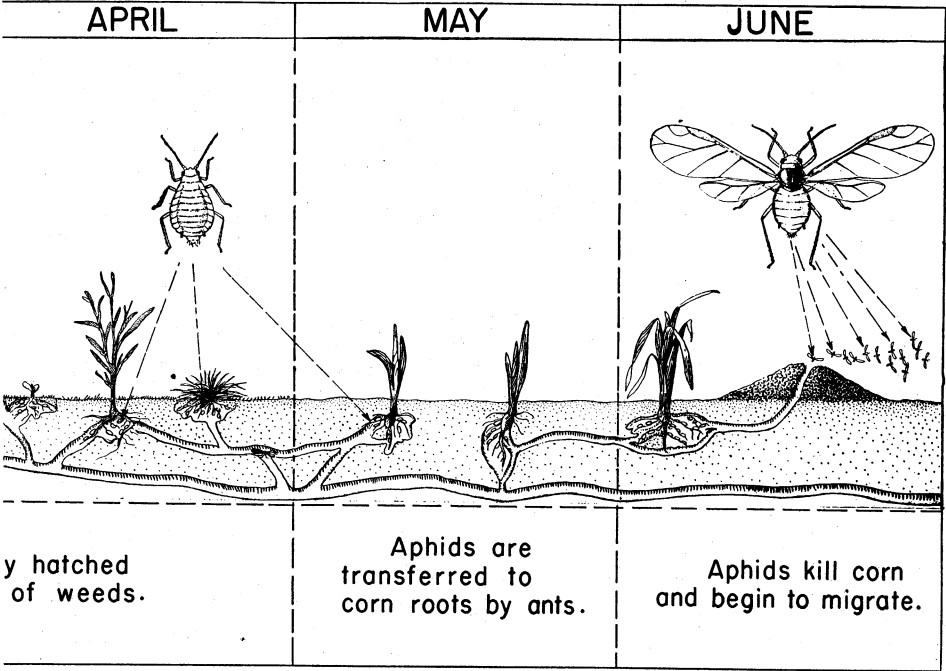


Figure 2.—Diagram showing history of the corn root aphid and its association with ants below the frost line, where



the cornfield ant. Note that during the winter the aphids are carried by the ants and the plow cannot reach them.

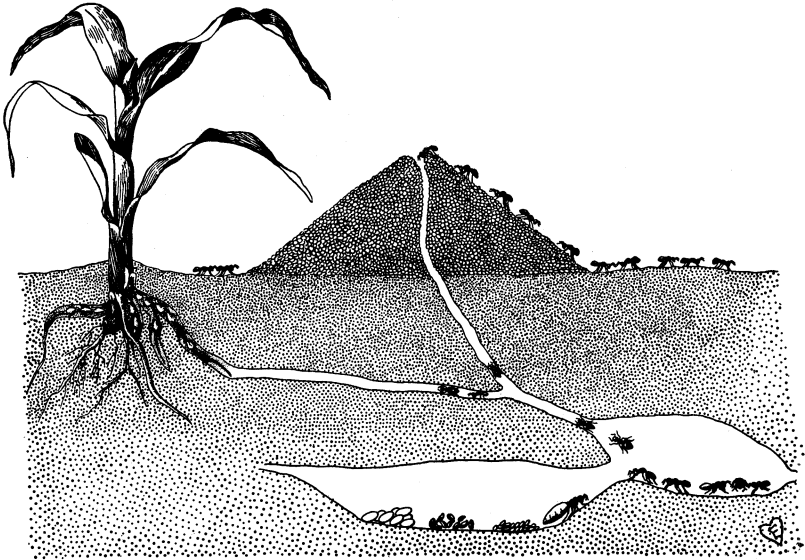


Figure 3.—Diagram showing how ants foster the corn root aphid by caring for the eggs in the ant nests during the winter and carry them through tunnels to place them on the corn roots.

where present on corn, usually beneath the leaf and ear sheath or the stalks of the unfolding tassel. The corn root aphid gradually increased in destructiveness until it was one of the most generally injurious insects affecting corn. Although this aphid is usually present wherever this crop is grown in the United States, rotation of corn with other crops tends to keep it in check.

METHODS OF CONTROL

Most of the measures for the prevention or control of the corn root aphid not only reduce or eradicate this and other insect pests of corn but constitute the more approved cultural practices, and for this reason are doubly important.

ROTATION OF CROPS

A rotation to avoid having two successive crops of corn on the same land not only prevents injury by the corn root aphid, but also controls other serious pests, especially the corn rootworm. In the Cotton Belt it is important also to avoid following cotton with corn, or vice versa, since both plants are hosts of the same aphid. No other cultivated field crop is seriously affected by this insect; consequently corn may follow in rotation any other field crop with reasonable safety. Occasionally corn is damaged in spring when rotated with other crops, such as clover, but in such cases smartweed and other wild plants preferred by the aphid have been abundant in the field the year before. In late spring or summer damage may occur in corn following a crop other than corn or cotton, and such infestations sometimes come from heavily infested fields nearby. Such damage is rare and occurs only in years unfavorable to corn growing.

CULTURAL PRACTICES

One of the most effective means of controlling the corn root aphid is thorough stirring of the soil before planting. This procedure disturbs the ant colonies and scatters and kills the aphids so that the corn and cotton plants may make a substantial growth before the ant and aphid colonies can become reestablished. It also prevents the growth of weeds upon which the aphids live, making it necessary for the ants to carry the surviving aphids to new fields.

Infested fields that are to be replanted to corn should be plowed to a depth of $6\frac{1}{2}$ or 7 inches in the spring, after March 15 in the latitude of central Indiana and Illinois. Then they should have three or four diskings to a depth of 4 or 5 inches with a 16- or 20-inch disk. When it is necessary to replant corn in a field where the first planting has been injured early in the season the field should first be plowed deeply and thoroughly and then disked deeply three or four times at intervals of 2 or 3 days. Though these practices require additional labor, they prevent injury by the corn root aphid and also put the field in a much better physical condition.

Plowing in the fall before the ant colonies go below the plow line is sometimes as useful as spring plowing, but if the weather becomes warm again after the plowing the ants may reconstruct their nests and replowing will be necessary in the spring. Whether the field is plowed in fall or spring additional spring diskings are essential.

Fall plowing and disking disturb the ant colonies, kill many of the aphids, and destroy the weeds upon which they live, and prevent the ants from forming new colonies. The result is a significant reduction in the number of aphid eggs to carry the insect over the winter.

MAINTENANCE OF SOIL FERTILITY

The use of barnyard manure or a commercial fertilizer has been recommended frequently as a control measure for the corn root aphid. This method is of value only in assisting the plants to outgrow injury either by this or any other insect that gradually affects the plant. It does not limit the number of aphids or ants, directly or indirectly, and can scarcely be included properly as a remedial or preventive measure.

IMPORTANCE OF COMMUNITY COOPERATION

One of the greatest obstacles to the control of insects injurious to field crops is lack of community cooperation. A farmer may protect his own crop from early injury by the corn root aphid by cultivation or rotation, but if heavily infested fields nearby are left untreated and the insect is permitted to live and multiply undisturbed the winged aphids may enter his fields. This is especially likely to be the case when spring weather is such that it permits the root aphid to multiply but delays corn planting. It is therefore important that every farmer rotate his crops and cultivate his old cornfields to destroy the root aphid and the attendant ant colonies, whether he plans to replant them to corn or not. If this is done by entire communities, serious damage by the root aphid can be prevented.

